Health Service Costs While on the Wait List

Technical Report

Hude Quan M.D., Ph.D.

Rene Lafreniere M.D. C.M., F.R.C.S.C., F.A.C.S.

David Johnson M.D. C.M., F.R.C.P., S.M., M.B.A

Alberta Centre for Health Services Utilization Research

For more information contact:

David Johnson, Coordinator
Alberta Centre for Health Services Utilization Research
22nd Floor, Telus Plaza North Tower
10025 Jasper Avenue NW
Edmonton, AB T5J 2N3
Ph: 780-415-0219
Fax: 780-422-2880

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INTRODUCTION

Patients wait for health services when resources are insufficient. Waiting time refers to the elapsed time from a request to perform a specific service until that service is performed. Waiting lists refer to a roster of patients waiting for the specific service.

Waiting lists do not directly assess the functional impact or distress associated with waiting[1-3]. However, just waiting for a therapeutic health service such as surgery may have an independent economic effect. If delay for surgery equates to failed problem resolution, then it is reasonable to hypothesize that additional health services will be required until the more definitive surgical service is performed. If true, then waiting for therapeutic health services such as surgery may artificially increase overall health service expenditures. If not true, the significance of waiting for surgery should be more closely scrutinized.

OBJECTIVE

In this study we compared the use of health services (physician claims, emergency visits, use of home care, length of hospital stay and pharmaceutical prescriptions for seniors) before and/or after five high volume surgeries. The cost of health services during the year prior to surgery and after surgery was then contrasted to the length of the waiting period.

CONCLUSIONS

We found that physician claims for health services decrease by no more than 30% after five common surgeries. The post surgical decrease in physician claims was smaller for those procedures with higher preoperative claims. We found no evidence to suggest that waiting for one of five common surgeries is correlated to greater expenditures preoperatively or a greater decrease in pre minus postoperative expenditures (physician claims, home care, Blue Cross prescriptions for seniors, and emergency site claims). Repeated preoperative visits to the procedural physician are correlated with a greater decrease in postoperative physician claims. These findings question using wait lists as the sole factor in determining the appropriate rate of surgical procedures.

METHODS

Study Time Lines

This study compares a one-year time interval immediately before and after surgery performed during the fiscal year 1997/98. Preoperative one-year period begins 365 days prior to each patient's hospital admission date. Postoperative one-year period ends 365 days post each patient's hospital discharge date. All claims during the procedure hospitalization are excluded.

Patient Inclusions

Patients were included if one of five specific procedures (hip and joint replacement, cholecystectomy, hysterectomy, and discectomy) was performed in any one of the three Calgary Regional Health Authority (CRHA) hospitals (Foothills, Peter Lougheed Center, Rockyview) during the fiscal year 1997/98. Records were first identified by ICD9-CM procedure code located within the CRHA inpatient and day surgery databases and retained if an appropriate Canadian Classification of Procedures (CCPx) physician claim (database maintained by Alberta Health and Wellness) could be located within ± 1 day of the ICD9-CM procedure service date. The specific coding for procedures are available from the authors.

Patient Exclusions

Patients were excluded:

1) A personal health number was absent from the original CRHA database or if personal health number could not be converted to an anonymous number linking the CRHA and AH databases.
2) Non Alberta resident at time of procedure or death /migration into or out of the province ascertained by linking to the AH health care recipient registry.
3) Not possible to match the CRHA record of procedure to a physician claim for procedure.
4) Length of hospital stay for the procedure was greater than 28 days.
5) Procedures in more than one index group (hip and knee joints, cholecystectomy, hysterectomy, discectomy) performed during the same admission.
6) Same surgery was performed on more than one occasion within the three-year study period.

Outcomes

Physician claims and emergency room claims during the year before the procedure, the year after the procedure and the difference between the two years.

Length of hospital stay.

Home care estimated costs based upon hours of care during the year after the procedure.

Blue Cross prescription dollars claimed during the year before, the year after, and the difference between the two years for seniors (age 65 and over) with subsidized Alberta Blue Cross registration.

Independent variables used for description and modeling

- Wait times (date when the CHRA receives a booking request for a specific procedure until the date of admission)
- Age and sex of patient on the date of procedure
- Residence within CRHA or out of CRHA on the date of procedure
- Physician service:
  1) by general practitioner
  2) service specialist, or
  3) all other specialists.

  Service specialist defined as:
  1) cholecystectomy - general surgeon
  2) hysterectomy-gynecologist
  3) total hip replacement and total knee replacement- orthopedic surgeon, or
  4) discectomy-neurosurgeon.
- By type of physician claim (consultation, procedure, or out of hospital diagnostic radiology)
- Whether patient visited procedural physician on more than one occasion before admission. Procedural physician analysis were restricted to patients in which a preoperative claim was identified by the same physician that submitted a claim for the index procedure.
- Total number of ICD9-CM procedures done during hospitalization for index surgery[4].
- Priority category (urgent, emergency, elective) as determined by procedural physician

RESULTS

Sample size

4,391 inpatient episodes and 951 day surgery episodes were selected from the CRHA hospital discharge data using the ICD-9-CM definitions for the five procedures. 901 patients were excluded yielding a final cohort size (one index surgery for each patient) of 4,441.

Demographics

Table 1 Age and sex composition by procedure

	Number of cases	Female (%)	Mean age (range)
Cholecystectomy	1838	73.0	47.4 (8-93)
Discectomy	400	41.8	43.2 (15-87)
Total hip replacement	440	68.2	70.4 (18-98)
Hysterectomy	1460	100.0	46.0 (17-90)
Total knee replacement	303	62.7	70.2 (27-90)

Waits

A description of waiting times is illustrated in Table 2. Note that the CRHA administrative records did not list a wait day for all patients. The median wait for joint surgery (knee replacement: 88 days, hip replacement: 65 days) was longer than the three other selected procedures (cholecystectomy: 29 days, discectomy: 21 days, and hysterectomy: 42 days).

Table 2 Waits for index procedures in final sample

Wait quartile (days)	Number	0%	25%	50%	75%	100%
Cholecystectomy	1455	0	10	29	69	294
Discectomy	352	0	11	21	56	357
Total hip replacement	313	0	35	65	126	492
Hysterectomy	1406	0	21	42	64	416
Total knee replacement	298	0	46	88	147	543

Table 3 illustrates the waiting times in each of three priority categories (emergency, urgent, elective) initially submitted with the booking request for surgery. Although in general average waits decrease from elective to emergent, a wide range in waits is noted for each priority rating.

Table 3 Average days wait by booking priority

Priority Average days wait (range) n= patients	Emergency	Urgent	Elective
Cholecystectomy	0.9 (0-37) n=83	12 (0-119) n=285	60 (0-294) n=1,087
Discectomy	0 (0) n=1	23 (0-124) n=177	65(4-357) n=174
Total hip replacement	0 (0) n=19	12(0-49) n=9	94(7-492) n=285
Hysterectomy	0 (0) n=4	16(0-168) n=180	55(0-416) n=1,222
Total knee replacement	——	32(0-97) n=7	107 (0-543) n=291

Pre and postoperative physician claims

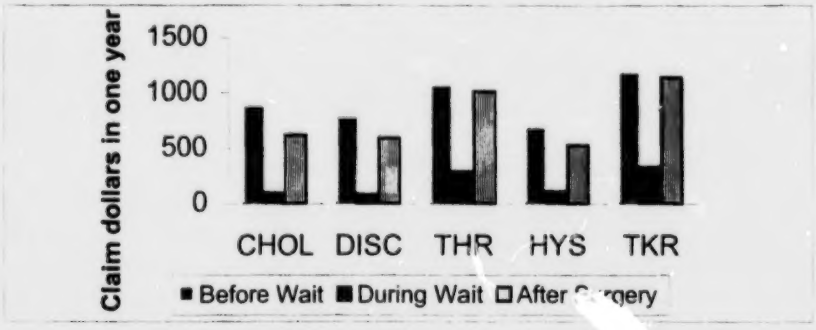
Figure 1 illustrates the total physician claims per patient before the waiting period, during the wait, and after the surgery. In all five procedures, total preoperative physician claims per patient decreased after surgery (cholecystectomy: 30%, discectomy:24%, hip replacement: 6% hysterectomy:23%, and knee replacement: 4%). The percent of pre-operative physician claims during the wait varied between procedures which simply reflected the relative proportion of the preoperative year spent waiting (cholecystectomy: 11%, discectomy: 11%, hip replacement: 27% hysterectomy: 16%, and knee replacement: 28%). After joint replacement surgery, physician claims per patient were nearly two-fold greater than the other three index procedures.

The per patient difference between before surgery claims and after surgery claims for out of hospital diagnostic imaging, procedures, consults, general practitioners and specialists are illustrated in Figures 2 to 4. Note that differences less than zero represent increased dollar claims post surgery. Claims for consults show the greatest decrease post surgery (cholecystectomy: 55%, discectomy: 86%, hip replacement: 119%, hysterectomy: 54%, and knee replacement: 189%). Claims for all non-service specialists show the greatest decrease post surgery (cholecystectomy: 77%, discectomy: 56%, hip replacement: 118% hysterectomy: 87%, and knee replacement: 106%). Claims for the service specialists do not show a consistent decrease post surgery (cholecystectomy: 11%, discectomy: 0%, hip replacement: gain of 59%,

hysterectomy: 47%, and knee replacement: 18%). Service and non-service specialist are defined in methods section.

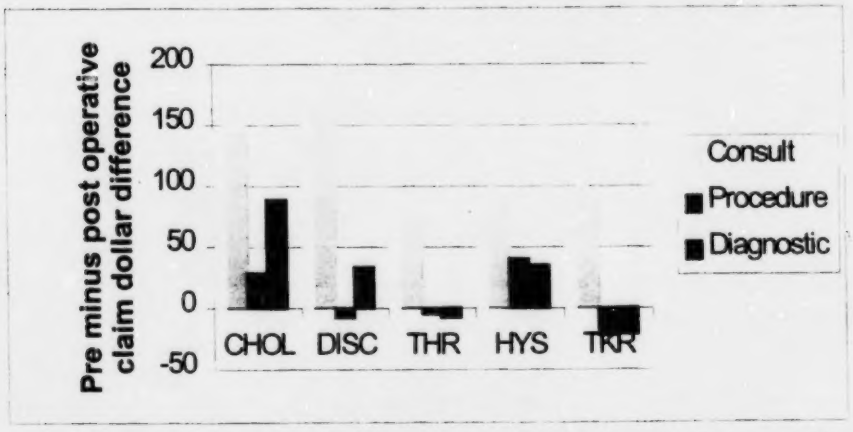
We restricted our analysis to only those patients in which a preoperative claim by the procedural physician was identified. In patients with an identified procedural doctor, preoperative claims were submitted: once (63.5%), twice (17.2%), 3 times (8.3%), 4 times (4.8%), and >4 times (6.3%). The frequency of more than one preoperative claim visit by procedure physician for each type of surgery were; cholecystectomy: 20%, discectomy; 19%, hip replacement: 35%, hysterectomy: 56%, and knee replacement: 42%. The differences between before and after surgery physician claims if the procedural physician was seen once or more than once are illustrated in Figure 5. Note that a difference of less than zero represents increased dollar claims post surgery. The difference between before and after surgery physician claims per patient are consistently greater if the procedural physician was seen on more than one occasion preoperatively. The dollar difference for the five procedures are; cholecystectomy: $159, discectomy: $125, hip replacement: $284, hysterectomy: $178, and knee replacement: $982. The dollar difference for the five procedures is still greater if the procedural physician was seen on more than one occasion even after eliminating all claims by the procedural doctor; cholecystectomy: $90, discectomy: $8, hip replacement: $83, hysterectomy: $83, and knee replacement: $587.

Figure 1 Physician claims pre and postoperatively by procedure



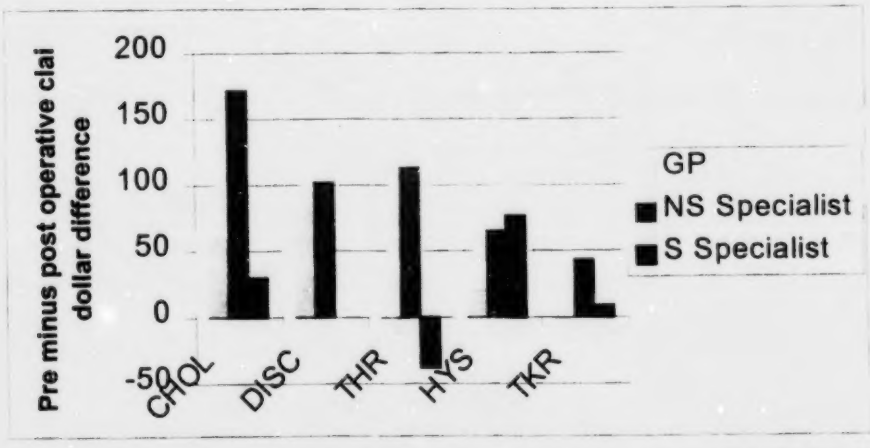
Note : Total physician claims per patient before and after surgery excluding all claims during the surgery hospitalization. Preoperative period is composed of before wait and during wait with histograms horizontally hatched . Postoperative period histogram is vertically hatched. Where chol (cholecystectomy), disc (discectomy), thr (hip replacement), hys (hysterectomy), tkr (knee replacement)

Figure 2 Contribution to pre minus postoperative claim differences by type of claim



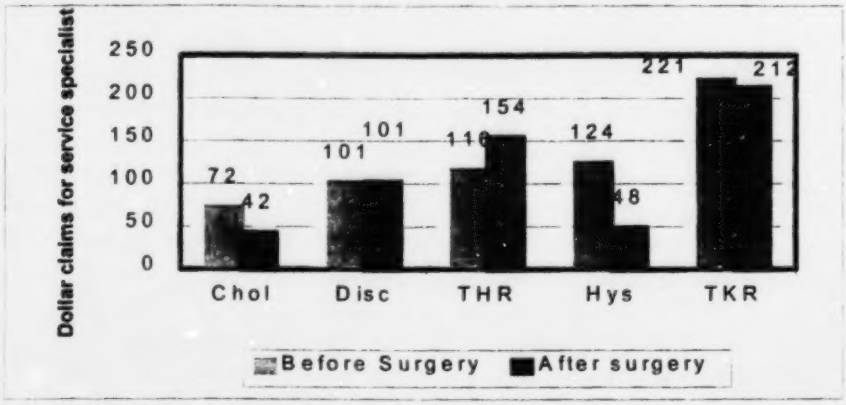
Where Chol (cholecystectomy), Disc (discectomy), THR (total hip replacement), Hys (Hysterectomy), TKR (total knee replacement)

Figure 3 Contribution to pre minus postoperative claim differences by physician type



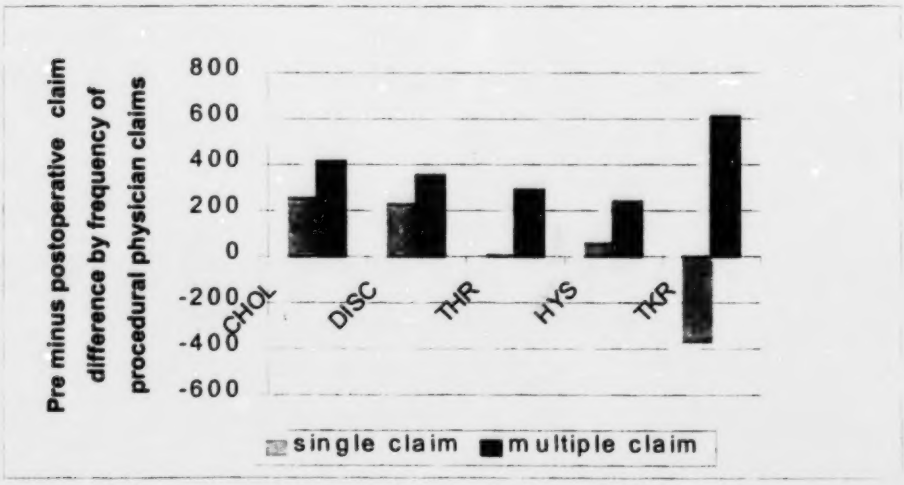
Note pre and postoperative physician claim claims by type of physician 1) GP-general practitioner 2) S Specialist -service specialist or 3)NS Specialist- all other specialists. Service specialist defined as 1) cholecystectomy-general surgeon 2) hysterectomy-gynecologist 3) hip replacement and knee replacement- orthopedic surgeon 4) discectomy-neurosurgeon. Where chol (cholecystectomy), disc (discectomy), thr (hip replacement), hys (hysterectomy), tkr (knee replacement)

Figure 4 Contribution to pre minus postoperative claim differences by service specialist



Where Chol (cholecystectomy), Disc (discectomy), THR (total hip replacement), Hys (Hysterectomy) TKR (total knee replacement)

Figure 5 Difference between pre minus postoperative total physician claim.



Note: Patients that were identified as seeing the procedural physician only once during the preoperative period are contrasted to those that visited the procedural physician multiple times during the preoperative period. The dollar amounts are not directly comparable with figure 1 as at least one preoperative claim by the procedural physician was not identified in 1,198 of the 4,441 total cohort. Where chol (cholecystectomy), disc (discectomy), thr (hip replacement), hys (hysterectomy), tkr (knee replacement)

Pre and postoperative emergency site claims

Claims deriving from emergency facilities (using a functional site field by the physician submitted claims) accounted for no more than 2% of total physician claims. The dollar difference in emergency claims from the year before and after surgery was small (cholecystectomy; 0.1%, discectomy: 0.4%, hip replacement: 0.4%, hysterectomy: 0.3%, and knee replacement: 0.4% of total claims).

Postoperative home care hours/dollars

Table 4 lists the home care costs attributed to each recipient in the postoperative period. As expected, joint replacement consumed more home care resources than other procedures.

Table 4 Home care recipients in postoperative period

	Home care recipients in postoperative period	Home care costs/ per recipient
Cholecystectomy	98	$840
Discectomy	26	$407
Hip replacement	214	$1,368
Hysterectomy	104	$521
Knee replacement	124	$822

Pre and postoperative Blue Cross prescription dollars for seniors

The administrative databases for Alberta Blue Cross are predominately restricted to seniors (Table 5). Seventy seven percent of 1,054 seniors (age >64) undergoing one of the five index procedures submitted Blue Cross prescription claims in the pre and post operative period (cholecystectomy; 79%, discectomy; 81%, total hip replacement; 74%, hysterectomy; 77%, and knee replacement; 77%). The before and after claims were similar in all procedures.

Table 5 Blue Cross prescription claims for seniors

	Number of Blue Cross recipients	Preoperative claims per patient	Postoperative claims per patient
Cholecystectomy	262	$744	$770
Discectomy	22	$819	$661
Total hip replacement	236	$1,015	$962
Hysterectomy	109	$575	$768
Total knee replacement	180	$950	$1,003

Length of hospital stay

Length of inpatient hospital stay was censured at 28 days and is illustrated in table 6.

Table 6 LOS by procedure for inpatients

	Number of cases	Mean (range)
Cholecystectomy	954	4.0 (1-28)
Discectomy	400	4.2 (1-24)
Total hip replacement	440	8.9 (3-28)
Hysterectomy	1459	3.6 (1-23)
Total knee replacement	303	7.4 (3-27)

Relationship of wait to health service expenditures

The determinants of wait time were modeled by multiple regression. The independent variables in the model were age, sex, emergent surgery, urgent surgery, number of comorbid diagnosis and procedures during hospital stay, length of hospital stay, hospital (one of three sites), residence in CRHA, and visit to procedural doctor on more than one occasion preoperatively. The model explains up to 37% of the variance in wait days (cholecystectomy; 30%, discectomy; 37%, total hip replacement; 37%, hysterectomy; 8%, and total knee replacement; 35%). Emergency surgery, urgent surgery, visit to procedural physician on more than one occasion, and length of hospital stay are inversely (i.e. less wait) associated with wait time.

Table 7 illustrates the distribution of average daily physician claims per patient in relationship to the preoperative waiting period. For comparison purposes a matched postoperative time period is also demonstrated. Although in general total physician claims were greater preoperatively, the distribution of total physician claims before or during the preoperative wait period is inconsistent. This descriptive presentation illustrates the findings of the statistical analysis (see below) of wait and physician claims.

Table 7 Total physician average daily claims related to wait period

Average daily physician claims	# patients waiting	Prior to wait day	After wait day	Matched wait postop	Matched prior wait postop
Cholecystectomy	1,455	2.48	2.05	1.66	1.64
Discectomy	352	2.08	2.02	1.7	1.52
Hip replacement	313	2.7	3.46	2.64	2.76
Hysterectomy	1,406	1.83	2.3	1.64	1.42
Knee replacement	298	3.23	3.24	2.55	3.32

The effect of wait upon the dependent variables of total physician claims (preoperative, postoperative, and preoperative minus postoperative) was modeled by multiple regression. Regressions samples are all patients (n=3,824) with a defined wait time (Table 8). The independent variables were wait time and visit to procedural doctor on more than one occasion. The independent variables of age, sex, number of procedures and diagnosis were used to adjust for confounding. Wait time was only weakly and inversely correlated (longer waits resulted in less expenditures) with total physician cholecystectomy claims (pre and postoperatively).

Table 8 Increase of physician claims (dollars) by increase in one day of wait time*

Coefficient for wait in multiple regression	Preoperative	Postoperative	Both pre and postoperative	Preoperative Minus postoperative
Cholecystectomy	-0.8**	-1.1**	-1.9**	0.3
Discectomy	-0.6	-0.1	-0.8	-0.5
Total hip replacement	-0.1	-1.1	-1.2	1.0
Hysterectomy	-0.8	-0.05	-0.8	-0.7
Total knee replacement	0.08	-1.0	-0.9	1.1

Note: * adjusted for age, sex, number of ICD-9-CM diagnoses, number of ICD-9-CM procedure and seeing procedure doctor once or more.
** $p<0.05$

Visit to procedural doctor on more than one occasion was strongly positively correlated with preoperative claims in all five index procedures, postoperative claims in cholecystectomy and total knee replacement as well as the preoperative minus postoperative differences for hysterectomy and total knee replacement (Table 9). Note that claims from all physicians were used in this analysis. The models variance explanation was uniformly low at no more than 10%.

Table 9 Increase of physician claims (dollars) if visit to procedural physician more than once preoperatively

Coefficient for procedural physician in multiple regression	Preoperative	Postoperative	Both pre and postoperative	Preoperative Minus postoperative
Cholecystectomy	235.9**	129.6**	365.5**	106.4
Discectomy	308.0**	143.4	451.4**	164.5
Total hip replacement	623.0**	-316.9**	306.1	939.9**
Hysterectomy	229.4**	57.5	286.9**	171.8**
Total knee replacement	295.2**	39.8	334.9	255.5

Note: * adjusted for age, sex, waiting time, number of ICD-9-CM diagnoses, annd number of ICD-9-CM procedure.
** p<0.05

The effect of wait upon the dependent variable of procedural physician claims (preoperative, postoperative, and preoperative minus postoperative) was modeled by multiple regression. The independent variables were wait time (Table 10) and visit to procedural doctor on more than one occasion (Table11). The independent variables of age, sex, number of procedures and diagnosis were used to adjust for comorbidity. Wait time was only weakly inversely correlated (longer waits resulted in less expenditures) with procedural physician hysterectomy claims (preoperative and preoperative minus postoperative). Visit to procedural doctor on more than one occasion was strongly positively correlated with preoperative and preoperative minus postoperative claims in all five index procedures. Note that only claims from procedural physician were used in this analysis. The models variance explanation was uniformly low at no more than 25%.

Table 10 Increase of procedural physician claims (dollars) by increase one day of wait time*

Coefficient for wait in multiple regression	Preoperative	Postoperative	Both pre and postoperative	Preoperative Minus postoperative
Cholecystectomy	0.07	-0.02	0.05	0.09
Discectomy	-0.3	-0.04	-0.3	-0.2
Total hip replacement	0.09	-0.3	-0.2	0.3
Hysterectomy	-0.2**	0.07	-0.09	-0.2**
Total knee replacement	-0.1	-0.2	-0.3	0.03

Note: * adjusted for age, sex, number of ICD-9-CM diagnoses, number of ICD-9-CM procedure and seeing procedure doctor once or more.
** p<0.05

Table 11 Increase of procedural physician claims (dollars) if visit to procedural physician more than once before admission

Coefficient for procedural physician in multiple regression	Preoperative	Postoperative	Both pre and postoperative	Preoperative Minus postoperative
Cholecystectomy	72.4**	7.7	80.1**	64.7**
Discectomy	160.1**	38.2	198.2**	121.9**
Total hip replacement	343.7**	-47.2	296.5**	391.0**
Hysterectomy	98.6**	6.9	105.5**	91.7**
Total knee replacement	210.5**	2.7	213.2**	207.8**

Note: * adjusted for age, sex, waiting time, number of ICD-9-CM diagnoses, annd number of ICD-9-CM procedure.
** $p<0.05$

In order to asses the importance of the time period chosen on the association of wait and total physician claims we: 1) restricted cases to only those with waits up to 250 days (in order to diminish the potential of claims before the year time period in those with longer waits); 2) restricted claims to only those during the actual wait period. Duration of wait was not significantly associated with preoperative, postoperative, and preoperative minus postoperative difference in all five index procedures when the time period was restricted to 250 days. In order to assess the association of wait with physician claims restricted to the actual wait period, we subtracted the waiting time physician claims from physician claims in a identical postoperative time period matched for each patient. In this manner we able to control for the increase in claims for any given increase in time period in which claims were summed. Duration of wait was not significantly associated with preoperative minus postoperative difference in all five index procedures when the time period was restricted to the wait period alone.

Wait time did not correlate to emergency site claims and Blue Cross prescriptions claims for seniors. Wait time inversely correlated with hospital length of stay (less wait greater length of hospital stay). Wait time was inversely correlated to costs (longer waits associated less with home care costs) in those patients undergoing total hip replacements. Analysis using wait times derived from booking list or claims (in the procedural physician restricted sample) did not materially alter the results.

DISCUSSION

Preoperative physician claims are a mixture of payments for care unrelated to the problem requiring surgery, care related to making the diagnosis in which surgery was recommended, and claims for care that may have been potentially avoided if earlier surgery had been done. Postoperative physician claims are payments for postoperative care (not bundled into the operative claim, which was excluded from these analysis) and care unrelated to the problem requiring surgery. There is no consistent change in claims during preoperative wait compared to preoperative claims prior to waiting. As claims summed over an increased time period are greater, we compared pre minus post operative claims for fixed time periods. Our results were robust for all time periods we counted physician claims (one year in those with waits up to one year, one year in those with waits up to 250 days, only the wait period for each patient). We found a weak inverse relationship with longer waits correlating to less (*not more*) peri-operative claims. Although we have no information on the health status of those that waited, any potential health status change while waiting did not translate into a measurable increase in health service consumption. Thus those that wait the longest may have a course of illness quite different from those that wait the shortest.

The number of patients on surgical waiting lists and the length of time they wait can be used as performance indicators and have been drivers of health resource allocation[5-8]. Increasing the number of services may not improve the waiting times nor decrease the wait list size[5-7]. Patients on waiting lists have their needs assessed by individual clinicians. No attempt is made to balance the effectiveness of the specific intervention for one particular patient compared to providing another type of service to someone else [9]. Focus on the target of wait time may divert attention from the quality, effectiveness, and appropriateness of the health service[10]. Differences in urgency, case severity, telephone access, or physician and patient personal values influence how long a patient waits[11-14]. The important issues about the delay to surgery are of equity (everyone waits equally), prioritization (those that need most receive first), and societal costs of waiting (cost of suffering, lost wages)[15-17].

Wait lists are not simple queues[17]. Waiting lists contain patients who have died, no longer require the service, obtained the service elsewhere, or self-deferred the service because of convenience issues[6]. Wait times are affected both by the time limitations of those providing the service as

well as the availability of resources. In the case of the typical single physician wait list, wide discrepancies exist in wait times among physicians providing the same service[15]. In this study, waiting decreased with multiple preoperative claims to the procedural physician despite the obvious need for time to elapse between procedural physician claims. Physicians prioritize patients on multiple occasions and in so doing likely limit potential claims due to delayed surgery.

Wait lists are used to argue for more resources[16]. In this study wait time is not a proxy for future health service use. Wait time does not estimate need [8,15-19]. It is likely that patients' self reports of need on wait lists will be influenced if patients know these self reports are used to prioritize queue rank [20-21]. The validity[22] and reliability of priority tools[23] may be insufficient for use within any one health service and are probably not a realistic way to prioritize between health services (in this manner indirectly determine relative health service rates). A successful example of a wait list management program (Ontario Cardiac Care Network[24]) may not be generalizable because of some unique features (strong anatomical determinants for priority setting, priority not determined by operating surgeon, pooled surgical referrals).

Then how should resource allocation for different health services be determined? This study argues that repeated visits to the procedural physician are a better indicator of future decrease in physician claims. Unlike wait lists in which patients may be placed and passively remain indefinitely[15] (up to nearly two years in this study), repeated physician visits requires active involvement by both physician and patient. Unfortunately, repeated visits are no less immune to gaming than wait lists. However until the emphasis on wait lists diminishes, little effort will be expended in systematically measuring potentially more useful markers for determining the relative resource allocation between services and the subsequent relative health service rates [24] (prevalence of the condition [25], health burden of disease [26], potential of successful intervention).

There are a number of limitations to this study. Physician activity was expressed in claim dollars. This is an appropriate economic metric but may not capture physician/patient interaction given the fee schedule peculiarities translating physician work to claim dollars. All physician claims and Blue Cross prescriptions were pooled as no reliable method exists to separate those claims that only pertain to the specific surgery. There are two methods in which wait lists can be analyzed: cross-sectional (all patients at a point in time as was done in this study) and longitudinal (follows patients over time). Although cross -sectional

analysis is most common, this method overestimates actual wait time due to sampling errors. Secondary use of administrative data should be interpreted with caution. We were able to cross validate both wait time and index surgical procedure using independent databases. Our measure of comorbidity was crude and unlikely to faithfully capture either case severity or comorbidity[4].

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AUTHORS

Hude Quan M.D., Ph.D.

Department of Community Health Sciences, University of Calgary, Calgary, Alberta

Rene Lafreniere M.D. C.M., F.R.C.S.C., F.A.C.S.

Regional Clinical Department Head, Director of Surgery, Foothills Medical Center, Calgary, Alberta

David Johnson M.D. C.M., F.R.C.P., S.M., M.B.A

Coordinator, Alberta Centre for Health Services Utilization Research

Professor of Medicine, Anesthesia, Community Medicine and Epidemiology, University of Saskatchewan, Saskatoon, Saskatchewan

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BIOGRAPHICAL INFORMATION

Hude Quan

Ph.D. of Epidemiology (University of Calgary, Alberta)

Diploma of Maternal and Child Health (University of London, UK)

Population and Economic Training Program (Asia and Pacific Development Centre of the United Nations, Malaysia)

Master of Public Health (Harbin Medical University, China)

M.D. (Harbin Medical University, China)

Consultant for the Alberta Centre for Health Services Utilization Research and the Department of Community Health Sciences of the University of Calgary

Dr. Hude Quan served as Deputy Director of the teaching and research committee, the Dept. of Social Medicine, Harbin Medical University, China, and as Epidemiologist of the National Prevention of Rickets Co-operative, Research Program of China. He was also a lecturer in Public Health (undergraduate and graduate courses) at Harbin Medical University, China. Since 1994, he has worked on research at the Department of Community Health Sciences, University of Calgary. Dr. Quan has published numerous reports and abstracts. His interests are evaluation of health service outcome and alternative medicine, and psychiatric epidemiology.

Contact Information:

Community Health Sciences
University of Calgary
Heritage Medical Research Building
3330 Hospital Drive NW
Calgary, AB T2N 4N1
Ph: (403) 220-6938
Fax: (403) 270-7307
Email: hquan@ucalgary.ca

René Lafrenière, D.E.C., M.D., C.M., F.R.C.S.C., F.A.C.S.

Dr. René Lafrenière is a Canadian who obtained his MD degree from McGill University in 1977. He then went on to pursue his surgical residency at Jacks Memorial Hospital in Miami and also completed a surgical oncology fellowship at the same Hospital. This was followed by a two-year research fellowship in tumor immunology at the National Institutes of Health. Since returning to Canada, Dr. Lafrenière has become Professor and Head of the Department of Surgery in Calgary. He has been closely involved with the American College of Surgeons serving as President of the local chapter and is now a Governor for the Province of Alberta and currently serves on the Governors' Committee on Surgical Practice in Hospital and the American College of Surgeons' Committee on Operating Room Environment. Dr. Lafrenière has a strong interest in population health and dynamics of healthcare delivery.

Contact Information:

Dr. René Lafrenière
Foothills Hospital
1403 - 29 Street N.W
Calgary, AB T2N 2T9
Phone : 403- 670-1697
Fax: 403 - 270-8409
Email: **rlafreni@ucalgary.ca**

David Johnson

MD (McGill) SM (Harvard) MBA (U of Sask)

Professor of Medicine, Anesthesia, Community Health and Epidemiology, University of Saskatchewan

Adjunct Professor Public Health Sciences University of Alberta

As a physician, my clinical practice is affected by the health care system. I am interested in understanding and promoting the use of information in directing health policy formation and decision making by the managers of the health care system.

Contact Information:

David Johnson, Coordinator
Alberta Centre for Health Services Utilization Research
22nd Floor, Telus Plaza North Tower
10025 Jasper Avenue NW
Edmonton, AB T5J 2N3
Ph: 780-415-0219
Fax: 780-422-2880
Email: david.johnson@gov.ab.ca